

Missouri Resources Magazine

Summer 1999

Table of Contents



Director's Comments



Swamped With Success

by Richard M. Gaffney



Missouri's Historic Border Battles

by Dwight Weaver



When Less is More

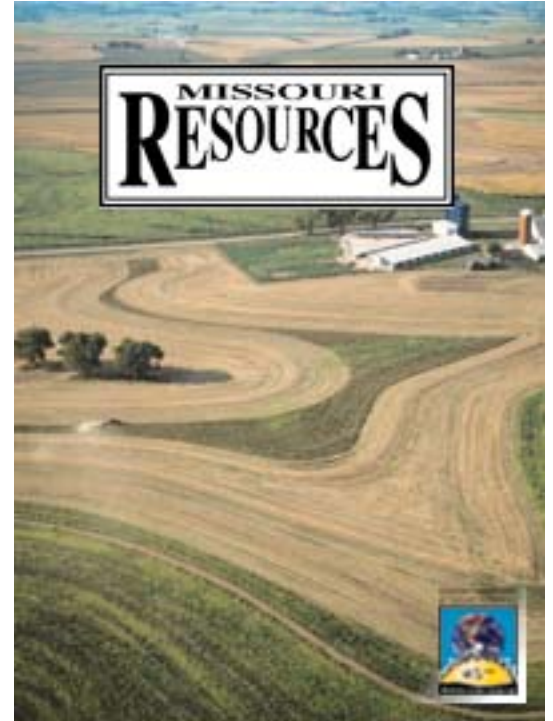
by Dennis Hansen



25th Anniversary Series - Part II Land: The last 25 years

Departments

**News Briefs, Environmental Notes, Resource Honor
Roll
and Letters**



FRONT COVER: The department promotes contour farming as an effective land-management practice that reduces soil erosion and maximizes crop yields.

BACK COVER: Early morning fog clings to gently sloping hills in Miller County.

Cover photos by Nick Decker.

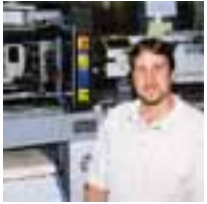


Resources to Explore: Trail of Tears State Park

by Denise Dowling

Teacher's Notebook: Re-Source Your Trash

by Jim Lubbers



One Last Word: Missouri Enterprise

by Kenny Seeney



Missouri Resources Magazine

Summer 1999

Comments from the Director:

I want to seize as many opportunities as possible to succeed in meeting the lofty goals established for this agency. And, when these opportunities support DNR's mission and benefit not only the State of Missouri, but also our employees, I can't help but think we've grasped a win-win situation. As I stated during my first year, the three areas we plan to focus our efforts are water issues, energy issues and efficient government. The State of Missouri has an opportunity to construct the first state office building that embodies the latest energy-efficient technologies, as well as use "green," or environmentally friendly, building materials. We can save taxpayer money and reduce environmental impacts in the long term.



Advances in building construction techniques provide opportunities for energy-efficient technologies: using natural sunlight to illuminate work areas; providing electrical lighting only when needed and lighting only areas in use; heating, cooling and ventilating systems specifically sized to building measurements; and operational controls and troubleshooting for the entire facility, controlled from a single desktop computer.

We read so often about sick-building syndrome and the harmful effects it creates on the health and productivity of employees. "Green" materials now are more readily available in office construction materials. These help eliminate potentially harmful volatile organic compound (VOC) odors from the manufacturing process. Chemical odors emitted by fabric in furniture, carpeting, glues, paints and from substances found in particleboard wood and other related building products cause serious health problems. Using "green" building products along with well-planned ventilating systems are and will become even more essential in assuring a healthy environment for our workers.

Our department has benefited from collaboration and support offered by the governor, lieutenant governor, key legislative leaders and other state agencies. The legislature authorized financing authority to assist public agencies and universities fund the construction and renovation of public buildings. Governor Mel Carnahan and Lieutenant Governor Roger Wilson have been supportive of our efforts and have provided leadership to DNR and its state agency partners. Together, we will make sure this building project exemplifies that leadership.

State Senate Appropriations Committee Chairman Wayne Goode has stated that he supports the project. "It makes sense both economically and environmentally," Sen. Goode said, and I agree wholeheartedly. "It's not one of those feel-good environmental deals. With this particular building, they will be setting a new standard the state should follow in the future."

Cutting operating costs and providing a healthy work environment for employees is extremely important to

everyone in state government, as well as for those working and operating in the private sector.

By thinking and visualizing outside the dreaded "box," the positive impacts for us all are clear. Better without being bigger; environmentally sound and saving taxpayer money in lower utility bills and fewer health problems for occupants. That's what Missourians expect and deserve.

A handwritten signature in black ink that reads "Steve Mahfood". The signature is written in a cursive, flowing style with a large initial "S".

Steve Mahfood
Director, Missouri Department of Natural Resources

Missouri Resources Magazine

Summer 1999

Watertight Savings for Summer

Summer is here and millions of gallons of water are flowing from sprinklers and hoses as we soak lawns, wash vehicles and spray plants. By following these basic tips, you can save water and still meet your warm weather, around-the-house watering needs.

- Check for leaks in outdoor faucets, sprinklers, pipes and hoses. Even the slightest drip or leak can add up to many gallons of wasted water.
- Avoid overwatering. A good way to determine if your lawn needs water is to step on the grass. If it springs back when you move, it does not need water.
- Place a layer of mulch around trees and plants in your yard. Mulch slows evaporation and discourages weed growth.
- Use a bucket of soapy water and a sponge to wash your car. Save the hose for rinsing.
- Plant trees and shrubs that thrive on less water than other species.
- Clean driveways and sidewalks with a broom, not a hose.

Source: Oklahoma Department of Environmental Quality

Missouri Resources Magazine

Summer 1999



LAND: THE LAST 25 YEARS

During 1999, the Missouri Department of Natural Resources (DNR) continues to celebrate its 25th anniversary. In commemoration, *Missouri Resources* has been presenting a "retro look" at four areas of environmental interest and importance to Missouri citizens.

Our spring issue addressed air resources in the state. In our summer edition, we will cover Missouri's land resources from the perspective of our divisions of Geology and Land Survey, State Parks, Environmental Quality and Energy.

Dams, boundaries, caves and geology

by Dwight Weaver

Geological Survey and Resource Assessment Division

Twenty-five years ago you could build a dam anywhere, any time and in any way in Missouri without a license or permit. This was, perhaps, one of the reasons why there were more than 20 serious dam failures in the state between 1957 and 1977.

In 1979, dam safety legislation became a reality in Missouri. Standards were established for the construction and maintenance of all non-federal, non-agricultural dams 35 feet or more in height. Since 1979, there have been no catastrophic failures of these dams.

Land surveying began in Missouri in 1815 to define the state's boundaries and describe land ownership. It took more than three decades for surveyors to establish the almost 300,000 public land corners for all of Missouri's sections, townships and ranges. But between the 1850s and the 1960s, two-thirds of these original land corner monuments were lost or damaged by land use and development. The state's Land Survey Authority, as a program, was assigned to DNR in 1974. Since then, almost two million survey records have been indexed and thousands of corner monuments restored.

In the 1950s, Missouri geologists began working with existing health agencies in geologic investigations of waste disposal sites. This became the engineering and environmental geology component of the agency. A sinkhole collapse in a sewage lagoon in the 1970s was predicted by a division geologist but ignored by the site engineer. This event highlighted the vital importance of geological site investigations. Since 1980, the environmental geology section has grown and diversified rapidly within the division. DNR geologists have led the nation in integrating the principles of geology and environmental protection.

Other important engineering and environmental geology activities have included defining geologic hazards such

as collapse or subsidence in karst areas and where underground mining has occurred, and the production of earthquake hazard maps for southeast Missouri.

Our state also is noted for its significant cave resources. In 1975, supported by other agencies, environmentalists, landowners, cavers and show-cave operators, DNR began an effort to establish protection for Missouri caves. This resulted in passage of the Cave Resources Act in 1980. Cooperation between private and public groups has resulted in the development of one of the largest state cave databases in the nation. The files are especially important in geologic site investigations and environmental protection of the cave resources.

Twenty-five years after the creation of DNR, our state boundaries are more precise, our dams are safer, and our caves are better known and understood. We have many new tools to use for environmental protection. We know a great deal more about geologic hazards indigenous to our state. Correspondingly, our public outreach services now respond quicker to information and technical assistance requests.

Acres, access to parks increase

by Sue Holst

Division of State Parks

In 25 years, the state park system has grown not only in its land base, but also in its significance.

In 1974, the state park system included 53 state parks and historic sites and was comprised of more than 77,000 acres. Today, the state park system has 80 state parks and historic sites and comprises more than 136,000 acres. The change is reflected not just in acreage but in the value of what natural and cultural resources have been preserved and the recreational opportunities that are provided to visitors.

Since 1974, significant natural resources have been acquired and protected, such as a large concentration of karst features; the state's largest remnant of native tallgrass prairie; a National Natural Landmark cave; and the state's highest point. Significant cultural resources added to the system include the homes of ragtime composer Scott Joplin, artist Thomas Hart Benton and explorer Nathan Boone, along with two American Indian sites, a Civil War battlefield, and the site of an important archaeological discovery. Recreational areas were added at two major lakes and along the Meramec River. Several unique parks were added: Katy Trail State Park, the longest developed rails-to-trails conversion project in the nation; Route 66 State Park, which is using a former Superfund site to interpret a slice of history; and St. Joe State Park, which allows off-road vehicle use on formerly mined land. While some of the land was purchased, more than 65 percent of the land in the state park system was donated or acquired at no cost.

To help guide the Department of Natural Resources' Division of State Parks on what should be added to the state park system, the division developed an expansion plan in 1992.

The plan was developed by department employees with input from citizens and constituents and helps identify criteria for which parks and sites meet the mission of the division and what possible "gaps" still need to

be filled in the system. Another plan developed in the early 1990s identified both external and internal threats to the state park system and ways to address them. The plan was part of an overall effort to restore and maintain ecosystems and landscapes through stewardship practices.

A milestone in the department's ability to manage the state park system occurred in 1984 when voters approved a one-tenth-of-one-percent sales tax for state parks and soil conservation. Voters approved this tax again in 1988 and 1996 by an almost two-thirds majority. This stable funding source has allowed expansion where necessary, and the repair and upgrade of facilities, infrastructure and system in general.

The result has been a system that recently was named one of the four best in the nation. More than 17 million people annually visit Missouri state parks and historic sites and a recent survey has shown that 90 percent of them were satisfied with the state park system.



Severe gully erosion is a prime example of the need to maintain the state's investment in successful soil conservation programs. With more than half the state's 44 million acres devoted to agricultural production, controlling and preventing erosion on Missouri farms helps keep food plentiful and prices reasonable for future generations.



Missouri has earned a reputation as a national leader in soil conservation. Terracing is an effective practice that has helped to reverse soil erosion.

Numerous, complex land issues faced
by *Connie Patterson*
Division of Environmental Quality

DNR's Division of Environmental Quality helps protect Missouri's land by overseeing the conservation of our soil and water resources, the reclaiming of mined land to productive use and the proper management of solid and hazardous wastes.

Agriculture has a significant impact on Missouri's environment; 60 percent of Missouri's land is in agricultural production. Land management issues have evolved from traditional, single-problem issues, such as soil erosion, to more complex environmental issues, such as agricultural nonpoint source pollution control, fertilizer and pesticide management, biodiversity and urban growth.

In 1982, 141.3 million tons of soil eroded from Missouri's 13 million acres of cultivated cropland.

By 1992, about 71.4 million tons of soil eroded from our cultivated cropland, according to the federal Natural Resources Inventory. An estimated 54 percent of the soil erosion reduction can be traced to federal, state and local programs targeting highly erodible land. Most of the funding to help farmers install conservation measures is supplied through Missouri's parks-and-soils sales tax.

The department minimizes the environmental and health-related impact of mining activities, including acid runoff, soil erosion, abandoned shafts and other unsafe conditions. Of the 170,060 acres of Missouri's land disturbed by mining activities, 51,360 acres have been or will be restored. Of the remaining 118,700 acres, 55,400 will not be reclaimed because they are naturally stabilized and are not considered to pose an environmental or safety threat. There is not enough funding available to restore the other 63,300 acres.

Missourians dispose of about 4.1 million tons of solid waste annually. Since 1990, DNR documented a 26 percent reduction in waste going to landfills through 1995; a 33 percent reduction in 1996; and a 30 percent reduction in 1997.

We generate about four million scrap tires each year. DNR uses a large portion of a 50-cent fee collected on each new tire sold in Missouri to clean up waste tire sites. This fund has removed about half of the 6.7 million tires located in illegal dumps. Tire cleanups, both state and owner financed, have removed about 2.85 million tires and eliminated 180 illegal waste tire sites in Missouri. Waste tires are used to fuel power plants and in rubberized asphalt for roads and playground surfaces.

The department registers all hazardous waste generators in Missouri and all out-of-state generators that import hazardous waste into Missouri. In fiscal year 1996, Missouri generators produced more than 786,000 metric tons of hazardous waste, nearly 323 pounds per person in Missouri. In fiscal year 1997, generators produced 447,000 metric tons, about 184 pounds per person in Missouri. This decrease is testimony that pollution prevention efforts do work.

DNR has the responsibility to pursue the cleanup of abandoned hazardous waste sites in Missouri. Seventy-five hazardous waste sites have been cleaned up over the past 15 years. There are more than 200 Missouri properties presently in the Superfund cleanup process.

DNR also works with individuals and businesses that want to voluntarily clean up hazardous waste-contaminated properties and return them to productive use. Since 1994, 200 contaminated properties have entered DNR's Voluntary Cleanup Program; 50 cleanups are now complete.

We have made progress over the past 25 years. But, we also have seen land management issues evolve from single problem issues to more complex issues. Nonpoint source pollution control, fertilizer and pesticide management, biodiversity and urban growth are challenges DEQ will face as we help protect Missouri's land resources for generations to come.

Land can provide more than fossil fuel

by Jim Muench

Division of Energy

The visible impact of energy production and use on our land can be seen in the power lines, pipelines and highways that crisscross our state. We affect our land whenever we build and heat our buildings or drive our vehicles across Missouri's tapestry of asphalt and concrete.

DNR's Division of Energy has witnessed a change in public opinion from centering on energy supply issues to the environmental consequences of energy choices. Twenty-five years ago, the most important factor was making sure our energy supply was reliable and inexpensive. Now a main concern is how our energy choices impact the world around us.

Over time, Missouri has begun to focus less on extracting fossil fuels from the ground and more on using fuel more efficiently and using the land to cultivate renewable fuel resources. In an economy based solely on fossil fuels, our state cannot compete as a producer and must import fuel from other states and countries. With its agricultural expertise, Missouri could be a leader in growing energy crops such as switchgrass, which can provide income from a farm's marginal acreage, help control erosion and remove carbon dioxide from the air.

Missouri also could become a leader in turning waste into fuel. Biomass fuel derived from leftover residues from harvested crops, animal wastes, unrecyclable waste paper and sawdust all can be converted into energy and removed from the waste stream. In addition, the methane gas created by the decomposition of solid waste in landfills can be collected and used to heat buildings, as shown in a demonstration project at Pattonville High School in Maryland Heights.

Energy use also is a key component of "smart growth" strategies that allow for more creative use of land. Planning can allow for more green space and effective use of roads to minimize urban sprawl and harmful vehicle emissions. Planning strategies that allow a mix of small business and residential homes, or that encourage walking, biking and other modes of transportation, can make our cities and towns more accessible and pleasant. Street layouts that help builders orient houses toward the sun allow for passive solar design. This saves money, increases comfort and reduces energy use.

As our population grows, questions of how best to use our land and energy resources will grow in importance. The effect of energy use on land is crucial to our future economic and environmental well being. The Division of Energy will work to ensure availability of more benign energy choices so citizens can make decisions that can pre-empt negative impacts on Missouri's environment.

Don't miss the fall issue of Missouri Resources, when we will take a retrospective look at Missouri's energy resources as addressed by DNR.

Missouri Resources Magazine

Summer 1999

LETTERS

I have a question about Jim Muench's article ("Air: The last 25 years," Spring 1999). He makes the statement: "As an engine burns one tank of gasoline, it emits about 300 pounds of carbon dioxide, hydrocarbons, nitrous oxides and suspended particulates." While the size of tanks varies, I suspect that the gasoline in any car tank would weigh much less than 300 pounds. Was it a mistake or do most of the emittants come from chemical reactions with the air?

Jim Gallen
St. Louis



Editor's note:

Your insight is correct. The additional weight above that of a tank of gas is due to chemical reactions with oxygen and other gases in the air.

I enjoy both *Missouri Resources* magazine as well as the associated web page. Each issue of the magazine is passed on to my sisters after I finish. Generally, there is an article on travel/vacation spots in each issue which is of particular interest to them as they are confirmed RVers. A few articles have been passed on to my brother, as well, who is considering the purchase of retirement property in Missouri. He has likewise appreciated my sending him your web page with its excellent links. I anxiously await the improvements which will enable me to direct him to specific articles which he can access on the Internet and the ability to check out older issues as well (I am only a relatively recent subscriber).

Tom Cornell
Rock Hill

Editor's note:

A chronological history of past topics is now available by issue and general category. Check them out at (www.dnr.state.mo.us/magazine/topic_history/index.html).

It is all well and good to add additional emissions tests for automobiles in the St. Louis area, but why will large trucks be exempt? (... "trucks with a manufacturers rating of 8,500 pounds in gross weight or more will be

exempt from ... testing" – *Missouri Resources* Spring 99, p.13) They surely cause considerable air pollution. And why not test vehicles in neighboring counties, or even further out, as many of them drive daily into and out of the St. Louis area? Testing just local automobiles surely will not solve the problem until the other major polluters are fixed.

Chuck Ehlert
St. Charles County

In our *Missouri Resources* Spring 1999 issue it says, according to EPA, from 1970 to 1997, overall emissions of six major air pollutants decreased 31 percent.

I understand that air pollution fell 66 percent or more nationwide and especially in major cities from 1950 to 1970, before the Federal Clean Air Act, according to a new report by the Center for the Study of American Business.

Priscilla Lyons
Rich Hill

Editor's note:

We found a copy of the report on the Internet and the reader cites it correctly. In fact, EPA was listed as the source for those statistics as well. A fact sheet on St. Louis Vehicle Emissions Inspections is available at our DNR web site at (/oac/pubs.htm).

Letters intended for publication should be addressed to "Letters," Missouri Resources, P.O. Box 176, Jefferson City, MO 65102-0176 or faxed to (573) 751-7749, attention: "Letters." Please include your name, address and daytime phone number. Space may require us to edit your letter. You also can e-mail Missouri Resources staff at moresdnr@mail.dnr.state.mo.us

Missouri Resources Magazine

Summer 1999

Missouri's Historic Border Battles

by Dwight Weaver

Whatever the diplomatic excuse, every conflict in modern times had its origin in some quest of property rights," former U.S. President Theodore Roosevelt said in a document, signed in 1916.

Such words could be used to characterize many of the boundary disputes that Missouri has had with adjacent states over the past two centuries, but the statement is even more fitting when one adds that capricious rivers are often the villains whose behavior precipitates such conflict.

Missouri is bordered by eight states – Arkansas, Illinois, Iowa, Kansas, Kentucky, Nebraska, Oklahoma and Tennessee – and the boundaries between Missouri and portions of all but one of these are defined in part by a river. The largest rivers include the Missouri and the Mississippi. There are few rivers in America more fickle, restless and unpredictable than the muddy Missouri and the mighty Mississippi. Like most rivers, they often have within their power the means to both give and take from landowners their most cherished possessions. And they can do it without remorse and almost in the blink of an eye, as people living along the two rivers learned during the Great Flood of 1993.

For nearly two centuries, these rivers have been leading actors in boundary disputes between people whose lives and livelihoods are tied to the land that borders them, and between the states they separate. Some quarrels have raged for generations. Typical of the boundary disputes are the ones that erupt periodically between Missouri, and Nebraska and Kansas along the Missouri River in a corridor that extends from the extreme northwest corner of Missouri south to Kansas City.

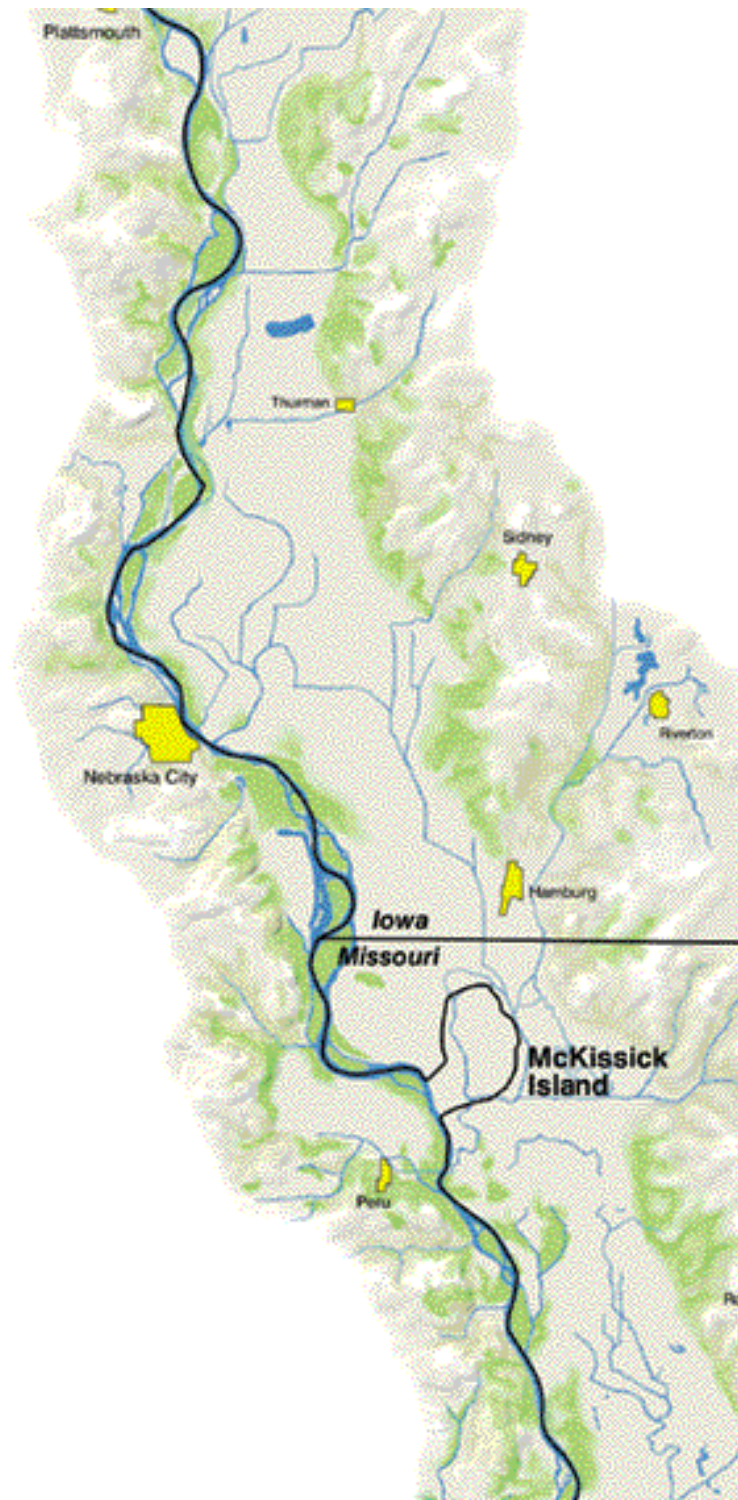
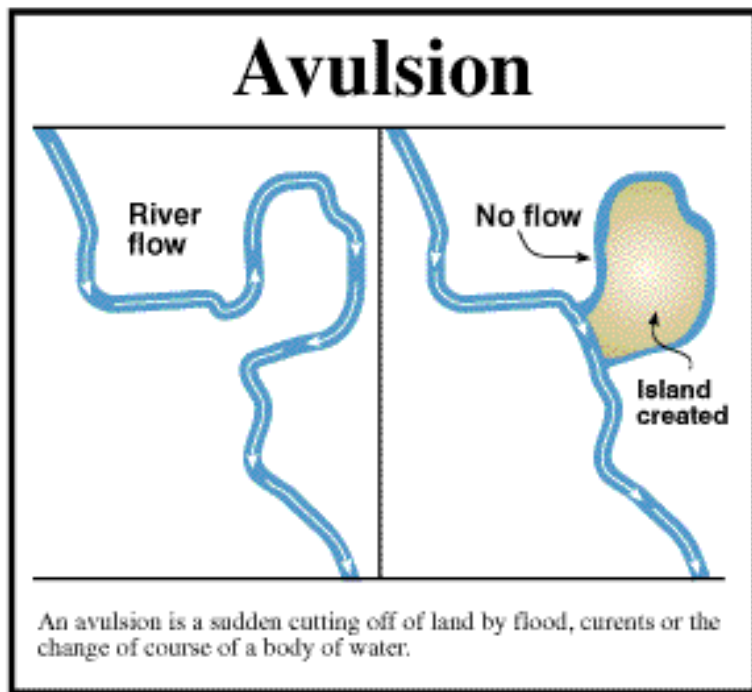
"In the 121 years ... men have been living along its banks north of Kansas City, where it serves as the boundary between Missouri on the east and Kansas on the west, the river has been in a constant state of change," said Ned Trimble, a reporter for *The Kansas City Star*, in 1958. "It has meandered crazily, creating new islands, cutting new bends, straightening others and sweeping away men's buildings with massive unconcern."

These actions, in essence, are among the chief reasons why boundary disputes occur generation after generation in this corridor where the Missouri River periodically cleans house and rearranges its accommodations. An article by John Eberhart of *The Kansas City Star* quotes a farmer as saying in 1989: "Every generation has to fight for this land."

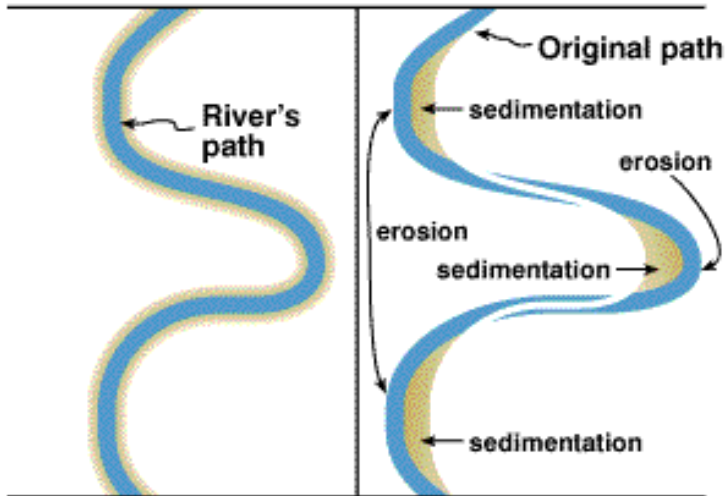
One of the more notorious disputes concerned McKissick's Island just two miles south of the Iowa line in the northwest corner of Atchison County. McKissick's is not really an island at all but more than 5,000 acres of fertile farmland originally on the Nebraska side of the river but now on the Missouri side. It started out as a tract of land

within a sharp bend on the west bank of the Missouri River, but a flood in 1867 changed its location. The river cut across the neck of the narrow bend and dug itself a new channel, shortening its course and isolating the acreage on the Missouri side. Gradually, the former riverbed dried up and became a part of the east bank. "Today, it is nearly impossible to determine where the old riverbed used to be. It's just a bean field," said Norman Brown, a surveyor for the Department of Natural Resources' Land Survey Program.

Problems with the change became acute by the year 1900 because people on both sides of the river claimed ownership of the McKissick's Island acreage. The problem was worsened by the actions of taxing authorities in the counties on both sides of the river who also claimed it. The Missouri people using the land refused to pay taxes to Nemaha County, Neb., and the land was eventually sold on the Nemaha County courthouse steps to a Nebraska farmer for delinquent taxes, hence initiating the battle between farmers. In 1905, the two states sued in the U.S. Supreme Court to determine which state owned McKissick's Island. Nebraska won.



Accretion



Accretion adds land by an accumulation of silt, sand and gravel along the inside bank of a turn in the river.



The Supreme Court determined that an "avulsion" had occurred. An avulsion is a sudden cutting off of land by flood, currents or change of course. In addition, the court set the boundary as the center of the river, which reaffirmed an 1867 agreement between the two states. Land surveyors call this difficult-to-define boundary, the "thalweg line," which is an old term meaning channel of commerce.

"The thalweg line is actually the deepest channel or 'sailing channel' of the river, not necessarily the center of the river," said Mike Flowers, state land surveyor and director of the Missouri Department of Natural Resources' Land Survey Program. "Man has often interceded into this situation in the last 64 years, especially since the U.S. Army Corps of Engineers became involved in maintaining levees and dikes to prevent flooding, and to control the river."

No better case illustrates this than the controversy over "The Chute," another chunk of riverbank farmland just west of McKissick's Island. Engineers working on the river channel in the late 1930s moved the river about 1.5 miles westward into Nebraska, switching the land between the old and new river channels to the Missouri side. Instantly, another boundary dispute was born. "The rich, uninhabited bottomland yields bountiful crops ... and is considered some of the best farming acreage in America," said one newspaper account written about the dispute.

One need only glance at a Missouri map to see what a meandering course the Missouri and Mississippi rivers take along and within the state's boundaries. Many hairpin turns of these rivers create opportunity for future disputes should the rivers get up and go wild. Nor are such disputes restricted to the western boundary of the state. Kaskaskia "island" just south of Ste. Genevieve along the Mississippi River was once on the Illinois side but is now on the Missouri side due to an avulsion, but it still belongs to Illinois. Another former conflict site is Wolf Island close to Towosahgy State Historic Site in Mississippi County near the town of Dorena.

While most of these disputes have cost the litigants large sums of money and generated hard feelings, real violence has been absent. There was a close call, however, early in the state's history when Missouri and Iowa went head-to-head over a contested tract of land. While historical accounts generally refer to this ludicrous

conflict as the "Iowa War," its more colorful name is the "Honey War."

This infamous skirmish occurred in 1839 in the extreme northeast corner of the state near the town of Athens where the Des Moines River forms a boundary between Missouri and Iowa.

"The boundary line (dispute) was the scene of at least three surveys and a near war before it ... was settled," said an account written in 1943. The misunderstanding came about over the phrase, "rapids of the River Des Moines," found in the enabling legislation of March 6, 1820, that authorized the people of the Missouri Territory to form a constitution and state government. Subsequent surveys made to correct problems in the original survey could not find the rapids. The citizens of Iowa claimed they were in the Mississippi River where the Des Moines River joins the Mississippi near Alexandria. Missourians placed the rapids in the Des Moines River near Athens. The area in dispute was sparsely settled and approximately 9 to 11 miles wide across Missouri.

The real trouble occurred in the summer of 1839 when Gov. Robert Lucas of Iowa and Gov. Lilburn Boggs of Missouri each issued proclamations warning the officers of the other's government not to extend their jurisdiction over the area claimed by both. Sheriff Uriah Gregory of Clark County, Mo., however, felt an obligation to collect taxes in the zone considered part of Missouri. His efforts resulted in his arrest and jailing by the sheriff of Van Buren County, Iowa. Before the fracas was over, both governors marshaled troops. Some 2,200 Missouri militiamen were called to arms, and about 1,200 Iowans countered. Though tempers flared, no actual battle occurred because boundary commissions were appointed to resolve the issue. However, one early incident during the conflict gave the event its more colorful name.

According to published accounts, a Missourian who cut down several bee trees in the disputed area was sued in an Iowa court, found guilty, and assessed \$1.50 in costs and damages. The court decision inspired John I. Campbell to write a poem titled "The Honey War." Sung to the tune of Yankee Doodle, it was a favorite in Missouri during the 1840s.





The Honey War

by John I. Campbell

Ye freeman of the happy land
Which flows with milk and honey,
Arise! To arms! Your ponies mount!
Regard not blood or money.
Old Governor Lucas, tiger-like
Is prowling 'round our borders,
But Governor Boggs is wide awake –
Just listen to his orders.
Three bee-trees stand about the line
Between our State and Lucas.
Be ready all these trees to fall,
And bring things to a focus.
We'll show old Lucas how to brag,

And seize our precious honey!
He also claims, I understand,
Of us three-bits of money!
Conventions, boys, now let us hold
Our honey trade demands it;
Likewise the three-bits, all in gold,
We all must understand it!
Why shed our brother's blood in haste,
Because "big men" require it.
Be not in haste our blood to waste,
No prudent men desire it.
Now, if the Governors want to fight,
Just let them meet in person,
And when noble Boggs old Lucas flogs,
T'will teach the scamp a lesson.
Then let the victor cut the trees,
And have three-bits in money,
And wear a crown from town to town,
Anointed with pure honey.
And then no widows will be made,
No orphans unprotected.
Old Lucas will be nicely flogged,
And from our line ejected.
Our honey trade will then be laid
Upon a solid basis,
And Governor Boggs, where'er he jogs,
Will meet with smiling faces.

(Sung to the tune of *Yankee Doodle*)

This poem was first published in *The Palmyra Whig* on Dec. 26, 1839. It was written by John I. Campbell, a local satirist from Marion County. Campbell became a founding member of the Missouri State Historical Society.

Dwight Weaver is the division information officer for the Department of Natural Resources' Geological Survey and Resource Assessment Division.

Missouri Resources Magazine

Summer 1999

NEWS BRIEFS

Renovations save energy dollars

Renovations to a Jefferson City building that will house DNR's Division of Energy and other state agencies should save an estimated \$46,000 annually in energy costs. The reduced utility costs will mean more efficient use of tax dollars.

The renovations, recommended after an analysis by the Division of Energy, include the installation of energy-efficient lighting fixtures, motion sensors to turn off lights when rooms are unoccupied, energy-efficient exit signs and a ground-source heat pump system. Heat pumps use the earth as a heat source in the winter. In the summer, they use the earth's natural ability to absorb heat to cool structures.

This summer, the division is scheduled to move into the building at 1659 East Elm Street in eastern Jefferson City.

"We wanted to demonstrate the potential of investing in energy efficiency," said Anita Randolph, division director. "Energy-efficient improvements are not difficult to implement; they just require us to think in terms of the long-term investment."

Columbia hosts waste conference

The 27th annual Missouri Waste Management Conference, "Building Partnerships," is scheduled for July 25-27 in mid-Missouri at the Holiday Inn Select, 2200 I-70 Drive Southwest, Columbia.

The conference, sponsored by the Missouri Waste Control Coalition (MWCC), will feature keynote speakers and 15 breakout sessions that will cover solid and hazardous issues, special waste issues, market development projects and other waste-management initiatives. Also, the annual meetings of several state organizations will be held in conjunction with the conference.

Jim Hull, director of DNR's Solid Waste Management Program, is president-elect of the MWCC and conference chair. Other department employees also will be featured as speakers and session panelists.

The registration fee for the three-day conference in Columbia is \$145 before July 10 and \$170 after that date. The "Partnerships" conference registration includes meals, a one-year membership in the coalition and a newsletter subscription to the MWCC.

For more information, contact Kenneth Seeney of DNR's Environmental Improvement and Energy Resources Authority, (573) 751-4919, or MWCC Manager Sandra Sabanske, (913) 381-4458. Her fax number is (913) 381-9308.

GSRAD School Day

On May 4, 1999, more than 350 Rolla eighth graders attended the third annual Earth Science School Day at the department's Geological Survey and Resource Assessment Division (GSRAD) in Rolla.

"The purpose of the event is to provide the students with opportunities to broaden their earth science education by learning, firsthand, about water resources, environmental geology, rocks, minerals, dams, reservoirs, land surveying and the importance of geology in their everyday life," said Mimi Garstang, deputy director of GSRAD. "During their visit, the students got to see what geologists, hydrologists, surveyors and other earth science professionals do every day, how they do it, and why such work is important."

Earth Science School Day is designed as an outdoor classroom experience. Six different learning stations are located on the grounds, with a special instructor at each site. Each student visits all six of the locations.

Although many GSRAD employees were involved, special presentations and demonstrations were made by Norman Brown of the Land Survey Program, Bruce Netzler of the Wellhead Protection Section, Jim Alexander of the Dam and Reservoir Safety Program, Bill Little, Cheryl Seeger and Chris Vierrether of the Geologic Data Acquisition and Mapping Section, and Jim Vandike of the Water Resources Program.

One of the day's highlights for the students was getting to see what the earth looks like beneath Rolla. The division has a demonstration water well on the grounds. A special camera was demonstrated that can be lowered into wells and other man-made or natural underground openings. It then transmits images to a monitor on the surface. Students could view underground rock layers and examine other features using this remote video equipment.

Earth Science School Day is one of the division's regular public information and educational activities.

Passport program returns with new challenges

The Missouri State Park Passport Challenge has begun and it charges participants to become actively involved to win patches and prizes. The new passport program features five theme categories: four that are activity oriented and one that is a photo scavenger hunt. Participants earn a patch for completing each theme category and a bonus prize for completing all five categories.

The four activity themes include "Time Traveler" (historic site tours); "Take a Hike" (hiking trails); "Be Our Guest" (lodging, dining, cave tours, etc.); and "Doin' What Comes Naturally" (naturalist walks or programs). By participating in the required number of activities, visitors can earn a patch for that theme category. The fifth category, the photo scavenger hunt, requires participants to visit 10 state parks and historic sites and then take a photograph to document their visit.

Participants can earn all five patches as well as a bonus prize, a full-color book about the state park system and a special passport booklet for next year's "millennium" program. The new passport challenge runs through the end of October.

Pick up a free passport booklet at any Missouri state park or historic site or call the department toll free at 1-800-

334-6946 or 1-800-379-2419 (TDD). Instructions for the passport program are available in Braille, large-print format and on audiocassette.

Clean water funds to increase

In May, the Missouri Legislature approved additional funds of \$44.6 million for DNR's Division of Environmental Quality. More than \$43.5 million of these funds will go toward protecting Missouri's water resources. This will include additional work on impaired waters, sampling at new monitoring sites, providing municipal facility operators training and assistance, and providing technical and financial assistance to the state's nonpoint source and agricultural communities.

The funds will provide management assistance to local watersheds and will assist with rural water, sewer and stormwater grants and loans. In addition, much of the funding will help local governments, citizens, business and the agricultural community protect their natural resources. Of the \$43.5 million designated for protecting water resources, about \$40 million will go to local communities in the form of stormwater, rural water, and wastewater grants and loans. More than \$2.6 million will expand Missouri's water quality standards. The remaining water quality-related funding, about \$639,000, will go toward reducing nonpoint source pollution and providing more assistance to Missouri's local watershed committees.

For more information, contact the department's Division of Environmental Quality at 1-800-361-4827 or (573) 751-6892.

Missouri Resources Magazine

Summer 1999

ONE LAST WORD

Missouri Enterprise

*by Kenneth Seeney
photograph by Nick Decker*

Russ Lindenlaub is a busy man. In fact, sometimes you have to call him on his car phone while he is driving down Interstate 44 near Rolla.

But he is not too busy to help Missouri businesses prosper. "Our job is to increase revenues, reduce costs and increase capital investments," Lindenlaub said. "That's how I measure our success."

Since 1997, Lindenlaub has been executive director of the Missouri Enterprise Business Assistance Center, headquartered in Rolla. Prior to that position, he was the director of Economic Development and served as city engineer in St. James.



Dave Gober of Neo Plastics Inc. in Hermann saw plastic materials headed to the landfill as a resource for his injection-molding business.

Missouri Enterprise is a non-profit organization that operates four programs: the Mid-America Manufacturing Technology Center (MAMTC-Missouri), Commercial or Defense Equipment (CODE), the Innovation Center, and the Environmental Services Program.

Last year, clients served by Missouri Enterprise reported a combined sales increase of more than \$40 million and cost savings of \$6 million. Also, capital investments exceeded \$4 million and 129 jobs were either created or retained.

The Environmental Services Program works closely with industry and assists companies by developing business plans, arranging financing, and identifying markets for recycled products. "In addition to our staff and resources, we depend on the expertise and services provided by other agencies and companies," Lindenlaub said. "The Department of Natural Resources (DNR) and the Department of Economic Development have been instrumental in the assistance we provide"

Lindenlaub strives to build strategic partnerships with small businesses, universities, research centers and corporations. "All of these entities play a role in the level of services we can provide."

Dave Gober is president of Neo Plastics Inc. in Hermann. About five years ago, he started a company that specializes in custom injection molding. With assistance from Missouri Enterprise, he began collecting, recycling, and processing plastic spools. He then sells the recycled spools to a distributor. Assembly lines at production plants use these plastic spools to stuff products into bags. He owns another company that manufactures "joysticks" (a steering mechanism that military pilots use to control their aircraft, such as F-18 fighter jets). At the other end of the spectrum, that same company makes lighted basketball hoops.

"When our company began to grow, we were interested in buying one of our customer's companies," Gober said. "But we needed to conduct an audit of this company to determine their stock value and we also wanted to evaluate our company's worth and projected worth." Missouri Enterprise provided the necessary software program to conduct the important audit.

Four years ago, DNR's Environmental Improvement and Energy Resources Authority (EI ERA) and Missouri Enterprise's Environmental Services Program developed a business partnership. The two organizations review applications from companies and businesses that are seeking financial or technical assistance.

"The partnership we have developed with Missouri Enterprise has been very beneficial to us, as well as businesses in Missouri," said Avis Parman, chairman of the EI ERA. "The Missouri Enterprise staff is currently producing a 15-minute video that will visually outline the services and opportunities provided by the Authority through Missouri Enterprise."

As Lindenlaub travels down I-44 and other highways, there are six words always ready to burst out of his mouth at meetings and other public events – "good environmental policies make good business." At Missouri Enterprise, they mean business – and a part of that philosophy means assisting companies that support a clean environment.

For more information, contact Missouri Enterprise Business Assistance at 800 W. 14th St., Rolla, MO 65401, or call 1-800-956-2862.

Kenneth Seeney is the assistant for planning and public affairs for DNR's Environmental Improvement and Energy Resources Authority.

Missouri Resources Magazine

Summer 1999

RESOURCE HONOR ROLL

Jerry Vineyard, formerly Assistant State Geologist and currently River Basin Coordinator for the Department of Natural Resources' Geological Survey and Resource Assessment Division, has received the department's Natural Areas Stewardship Award. Natural areas are biological communities or geological sites in a natural or nearly undisturbed state.

Vineyard is a charter member (since 1977) of the Missouri Natural Areas Committee. The group consists of members from the Missouri departments of Conservation and Natural Resources, as well as the National Park Service and U. S. Forest Service. The committee's primary goal is to identify, select, and protect outstanding examples of Missouri's terrestrial, aquatic, and geologic features that make up the state's natural heritage.

As a geologist, writer, editor and speleologist, Vineyard is widely respected for his knowledge of caves, springs and karst formations. He was born and raised on a Pulaski County farm. A cave and spring on the family farm sparked his early interest in geology. The spring was the family's source of water and he often quips that they had running water in their home when he was a kid because every time they needed water, his mother would have him run to the spring to fetch it!

The list of credits to his name are far too extensive to list here, but he co-authored the *Springs of Missouri* (1982), and contributed to the original and worked on the revision of *Geologic Wonders and Curiosities of Missouri* (1990). Both books have been used as references to recognize the state's outstanding geologic features. Vineyard also was the principal person in the development of the 1980 Missouri Cave Protection Act.

Many of the 122 natural area nominations reviewed by the Natural Areas Committee during his tenure reflect his contributions. His dedication served the committee well as he chaired the group from 1995 to 1998.

Although semi-retired, Vineyard's current position as River Basin Coordinator is work that involves the water and water rights for the Missouri and Mississippi rivers, as well as the rest of the diverse waterways in Missouri.



Jerry Vineyard

Missouri Resources Magazine

Summer 1999

RESOURCES TO EXPLORE

Trail of Tears State Park

by Denise Dowling
photographs by Nick Decker



A boardwalk provides access between the park's amphitheater and visitor center.

Looking across the river today, one can only imagine the suffering that was taking place more than 150 years ago. Disrespectfully uprooted, homeless, they were embarking on a long journey in worn-out moccasins in the unforgiving dead of winter. Enduring river crossings, ice floes and relentless winds, they had only a blanket for warmth – if they were lucky. You imagine huddling around a fire, comforting your mother while she gets weaker and weaker ... wondering, as she, when the suffering would end, and whether she would even live to see it.

Despite its scenic beauty, these are some images that come to mind while visiting Trail of Tears State Park. Located along the Mississippi River in Cape Girardeau County, the park commemorates an infamous episode in American history. The Cherokee, one of the Five Civilized Tribes, were forced to relocate from their native homeland in present-day southeastern United States. The Cherokee walked 800-1,000 miles to Indian Territory, which now is the state of Oklahoma. During the winter of 1838-39, the Cherokee made this trek, crossing the Mississippi River from Willard's Landing in southern Illinois via Green's Ferry to Missouri. Another crossing was made about five miles downstream at Bainbridge, Mo. The Cherokee moved in groups of about 1,000. The ferries had trouble crossing the river due to ice

floes, and some groups were separated and stranded until everyone crossed. When a group was finally together, they would start the march again.

The road leaving the crossing was known as Greensferry Road and led into Jackson, Mo. Today it is a major park road, although it has been renamed

Moccasin Springs Road. As you travel through the park, you will pass the Otahki Memorial. This memorial is dedicated to all the Cherokee who were forced on this march – those who survived and those who did not.

The citizens of Cape Girardeau County knew about this historic route and wanted it preserved for all citizens. Options were secured and a bond issue passed to purchase the property. "The citizens of Cape Girardeau County may claim several 'firsts' – theirs will be the first Missouri county to vote bonds for purchase of land for state park purposes; the park will be the first Missouri State Park located on the Mississippi River, its title, 'Trail of Tears,' will be the first tribute to the tragic westward exodus of the Cherokee Indians," according to a newspaper article written just prior to the election.



The two-mile portion of this historic route, located within the park, is certified by the National Park Service as a part of the Trail of Tears National Historic Trail. A slide show and displays located in the park's visitor center provide the details about the forced removal. This is the only visitor center located along the Trail of Tears National Historic Trail. Other displays in the visitor center discuss the unique natural history of the park, and staff are available to answer questions.

Although it commemorates a tragic piece of history, the park itself also preserves outstanding natural features. A drive through the park will reveal many steep hills and ridges with sheer drops. There are many trees typical of the Ozark

Mountains of Missouri: various oaks, hickory, maples, sassafras and dogwood. However, Trail of Tears State Park also has a flavor of the Appalachian Mountains with many tall and stately beech, tulip poplar, and cucumber magnolia trees. The ground cover is rich with many ferns, and if you look carefully you may find the delicate and rare pennywort, a spring wildflower.



The Missouri state park visitor center is the only one located along the Trail of Tears National Historic Trail.

The park contains both a natural area and a wild area. Natural areas are biological communities in a natural or nearly undisturbed state – something that existed before the settlement of Europeans. They are permanently protected to preserve their natural qualities. Designated in 1977, the 300-acre Vancill Hollow Natural Area represents a complete watershed in extremely rugged topography, and is a good place to see some of the trees more common to the Appalachians. Wild areas are large tracts of undeveloped land, that preserve the wild character and natural values of a wilderness setting. Wild areas require a minimum of 1,000 acres, where natural areas have no size limitations. Designated in 1978, the 1,300-acre Indian Creek Wild Area provides a wilderness setting for horseback riding, backpacking and hiking opportunities along the 12-mile Peewah Trail. Other trails in the park include the two-mile Sheppard Point Trail and Boutin Lake Trail, and the half-mile

Nature Trail behind the visitor center.



Lifelike displays help document how Cherokee Indians survived their grueling westward exodus.

for a fee.

An overlook along the bluffs offers dramatic views of the Mississippi River and the countryside. Three parking areas along the road also provide views of the river.

The park has an abundance of wildlife. Common park creatures include deer, raccoons, skunks and opossums. During certain seasons, you may see something special such as a bobcat or large flocks of turkeys in the late fall. Many people watch for American bald eagles along the Mississippi River in the winter. And a special treat is to spot Mississippi kites in the summer. The location of the park offers an excellent opportunity for birding along the Mississippi Flyway during the spring and fall migrations; ospreys are among documented sightings.

Programs about the park's natural and cultural history normally are offered on weekends from Memorial Day through Labor Day. Programs also are available to groups by appointment.

Items of interest in the immediate area include the Mississippi River Trail, a bicycling trail that passes beside the park. The Mississippi River Trail spans more than 220 miles in southeast Missouri. It enters Missouri in Ste. Genevieve County, follows back roads throughout eastern Missouri along the Mississippi River and exits the state in Mississippi County. Upon completion, the biking trail will extend 2,000 miles through seven states.

Highway 61, which runs near Trail of Tears State Park, has been designated as part of the 3,000-mile Great River Road, a

There are two campgrounds at Trail of Tears State Park. The campground without electrical hookups is located on the ridge overlooking Boutin Lake. Boutin Lake is a popular swimming area during hot summer days and a favorite fishing spot for many anglers. The 20-acre, man-made lake is accessible by boat; however, gas motors are not allowed. The campground with electrical hookups is located near the Mississippi River. Campers can enjoy watching tugboats push barges along the river, and every now and then are treated to the passing of one of the big steamboats. Picnic areas are scattered throughout the park and there are two picnic shelters that can be used on a first-come, first-served basis or can be reserved

scenic byway that provides access to scenic and historical sites that showcase the mighty Mississippi River. Trail of Tears State Park is one of the designated sites along this byway.

A trip to the area will offer a beautiful and diverse panorama of natural surroundings. It also will provide a unique glimpse into a brief but tragic event in our nation's history. Both aspects make a visit to the park doubly rewarding.

Trail of Tears State Park in Jackson is operated and maintained by the Missouri Department of Natural Resources. For additional information, contact the park's staff at (573) 334-1711, or call the department toll free at 1-800-334-6946. Persons with hearing impairments can call 1-800-379-2419 with a Telecommunications Device for the Deaf (TDD).

Denise Dowling is the naturalist at Trail of Tears State Park within the Department of Natural Resources' Division of State Parks.



With many picnic sites located in the park's 3,415 acres, visitors have a unique opportunity to enjoy recreational activities and learn more about American Indian history.

Missouri Resources Magazine

Summer 1999

Swamped With Success

by Richard M. Gaffney
photographs by Nick Decker

There is a bit of wisdom that says, "If all you have are lemons, make lemonade." Through partnerships and breaking with traditional thinking, that is exactly what some Missouri landowners are doing with portions of their property long considered "wastelands."

Such "wastelands" may happen to be areas that stay wet much of a year, making them unsuitable for crop production or even grazing. But such areas may be well suited for wildlife, and perhaps other uses, with help from their owners.



The view from a hilltop located on Dwayne Melugin's Oscie-Ora Wildlife Refuge in Jasper County reflects the expansiveness and park-like character of the land. School groups have found it to be a valuable resource for wetland studies.

of the Wildlife Society in 1992, in recognition of his wetland projects. He received technical assistance from the Missouri Department of Conservation (MDC) and the U.S. Fish and Wildlife Service.

This help has converted some such "wastelands" in Missouri into successful wetland projects that reap a heap of benefits for their owners, wildlife, and often the public as well.

In southeastern Missouri, where level floodplains seem to reach as far as the eye can see, Davis Minton broke with the tradition of his ancestors and saved a hill as well as a swamp on his land. Called Moccasin Ridge, the natural hill was shown on old maps of Stoddard County.

"Years ago, I would have leveled that ridge and distributed it across the fields, but people have shown me alternatives," said Minton. He received the prestigious Farmer/Wildlife Award from the Missouri chapter

To both preserve and enhance areas with wetland potential on his land, Minton has planted trees, installed water-control structures, moved earth when it was essential and changed some of his farming practices. For instance, during fall and spring bird migrations, he leaves some fields under shallow water to provide resting and feeding

places for huge flocks of migratory waterfowl. When harvesting rice, he leaves stalks bent down in the water to provide low cover for birds and habitat for invertebrates, a food source.

"A piece of ground which could have been a liability (worthless on its own merit), if converted to a wetland, maximizes the land value and the natural resource value," Minton said.

Davis Minton's business card has five small pictures on it – a cotton boll, a rice stalk, an ear of corn, a flying mallard and a shotgun. "That tells you about all you need to know about me!" he grinned.

While duck hunting is one of the benefits of Minton's land management plan, it's an entirely different story on the property of Dwayne R. Melugin in Jasper County. Here, the Webb City industrialist has converted 160 low-lying wet acres near Center Creek into a park-like wildlife refuge. This area in southwest Missouri is a place where he can pursue hobby skills like stone masonry, carpentry, and steel fabrication, and where he can bird watch and collect ancient flint spearheads.

Melugin has built a unique "crow's nest" observation platform in a tall oak tree, where he can observe the wetland wildlife while having supper. Breakfast in his "tree house" is a rare treat. He named his wildlife refuge "Oscie-Ora," after his two grandmothers. Scout groups and college students have limited access to the refuge for outdoor studies.

In order to have some productive use of his land, Mr. Melugin raises Shiitake mushrooms in white oak logs near the pecan trees he has planted.

In central Missouri, Dorothy and Gerald Oswald are the owners of 428 acres of Missouri River bottomland that flooded in 1986. Understanding the potential for ducks, geese, deer, turkey, and beaver, the couple placed most of their Cooper County floodplain land into the Wetland Reserve Program in 1992, just one year before the bottoms were inundated by the Great Flood of 1993. That flood gouged large scour holes in the floodplain, and also deposited about twelve inches of dark brown sediment. Besides the other wildlife, the scour holes now make a suitable habitat for fish, turtles, herons and egrets.



With some technical assistance from the Natural

A "crow's nest" observation tower built into an oak tree on Dwayne Melugin's land affords a great view and excellent picnic site.

Resources Conservation Service, the Oswalds' bottomlands no longer are a financial liability. They are a haven for wildlife. On one visit to the bottoms, a rare blue grosbeak was seen in the trees. Mr. Oswald



Melugin, left, chats with friend and wildlife consultant Ed Landreth on a walk through the Oscie-Ora Wildlife Refuge.

first visited this property in the 1930s, when all that was north of the Missouri Pacific Railroad was the river. Today, with the U.S. Army Corps of Engineers' river training works, a wide floodplain has formed on the south bank. This is where the wetlands are situated.

Gerald Oswald received the 1993 Missouri Partners for Wildlife award from the U.S. Fish and Wildlife Service and MDC.

The land management goal at Buckner, in Jackson County, practically on the doorstep of the Kansas City metroplex, was to take a natural marshland in the midst of cultivated fields, and convert it into a wildlife habitat with both recreational and educational values.

Here, it was an unusual partnership of visionaries that accomplished the feat. The team included the public works supervisor for the City of Buckner, the district manager of the Jackson County Soil and Water Conservation District, and Ed Winfrey, a neighboring farmer and Boy Scout leader. There were others, too, who gave of their time, energy, expertise and resources.

Today, the 11-acre patch of ground is open to the public and thrives with wildlife and the blossoms of wildflowers, such as fringed blue gentian, arrowhead, and swamp milkweed.

Another interesting wetland success story involves the collaboration of two adjoining property owners in northern Lewis County, not far from the North Fabius River. Hilburn Fishback, a farmer, and J.D. McCutchan, an Angus cattle breeder, own hilly land just above the river. The lower portions are always damp. These two men agreed in the early 1990s to jointly operate their wetlands.

"Hib" Fishback related that on one hill, there is a spring, and in this area, stone artifacts were found after the land was plowed. Perhaps, in prehistoric times, the site was a Native American campsite just above the river. Mr. McCutchan related that they tried to plant crops in this area, but most years it was too damp. The area now is a jointly managed wetland and utilizes a weir (a miniature dam used to adjust the level or divert the flow of water in an area). The impetus for the project was the Partners for Wildlife Program of the U.S. Fish and Wildlife Service, which provided some of the funding.

Tracks seen at these wetlands included great blue heron, wild turkey, deer, raccoon, coyote, and opossum. Bald eagles, wood ducks, and other wildlife also can be seen regularly. Wildflowers in the wetlands include orange spotted jewelweed, boneset, broadleaved arrowhead, smartweed, and coreopsis. The Fishback and McCutchan properties have been accepted into the Wetland Reserve Program.



Gerald and Dorothy Oswald survey riverbottom acreage on their farm near Boonville. Gerald Oswald first saw the land while on a childhood hunting trip.

These four examples of successful wetlands typify a trend that is changing



Wetland areas, such as Dwayne Melugin's, offer attractive critical stopovers for migrating waterfowl.

Wetlands: A Vanishing Resource, by Jane Epperson, Water Resources Report No. 39, supported by an EPA grant, was published in 1992. This research was supported in part by a 1995-1998 EPA grant. A current DNR project focuses on remote sensing for identifying wetlands in Missouri. Wetlands also play a role in removing pollutants and excess nutrients from storm water runoff, and some local governments use wetlands to further treat wastewater treatment plant discharges, to improve water quality.

Richard M. Gaffney is chief watershed planner for the Water Resources Program within the department's Geological Survey and Resource Assessment Division.

the way many landowners and farmers manage their property. For these people, the goal is to use available financial and technical assistance provided by government agencies to work wetlands into their land management plans and farming operations.

Four different landscape settings, four unique combinations of people and resources, but they succeeded by forging public and private partnerships.

The department has had several wetland grants from the U.S. Environmental Protection Agency (EPA). Missouri

Missouri Resources Magazine

Summer 1999

TEACHER'S NOTEBOOK

Re-Source Your Trash

by Jim Lubbers

photographs by Nick Decker

The Missouri Department of Natural Resources is pleased to introduce "Re-Source Your Trash," a curriculum guide to help you think a little differently about solid waste in Missouri. The title implies actions to reduce, reuse and recycle as the means for thinking of trash as a resource rather than as waste. The guide offers ready-to-use lessons, targeting grades four through eight, which encourage the understanding and personal responsibility needed to help reduce waste.

Waste reduction is an important goal for many reasons:



This 600-pound, 4-foot by 6-foot cube of aluminum cans will be processed for new use as soda cans and aluminum siding.

- It makes sense to spend our money on saving resources rather than burying them. Also, the "resource-to-product-to-waste" system of resource use is not a sustainable system.
- Besides saving resources, waste reduction decreases environmental impacts resulting from the processing of raw materials, and from landfills and other potential sources of pollution associated with waste disposal.
- As we enjoy seemingly unlimited resources, we have an obligation to people less fortunate and to future generations to use resources efficiently and to set an example of environmental stewardship.

"Re-Source Your Trash" is based on these reasons and more, and is designed to motivate individuals

to re-think their waste habits.

The 23 lessons are grouped into four sections: Sources of Resources, Sources of Waste, Integrated Waste Management, and Managing

Your Solid Waste. The framework is based on the issue investigation approach and most of the lessons incorporate a "learning cycle" method of instruction. Lessons may be used independently to supplement your school's curriculum or the entire guide can be the basis for a six- to nine-week unit.

A Sample Lesson and Course Activity

The Fourth R – RESPONSIBILITY

Students choose a "re-" action verb to "reinforce" the Three Rs as a method for accepting personal responsibility for managing waste.



Objectives – STUDENTS WILL:

1. Understand the Three Rs as action verbs and realize that there are many other "re-" action verbs that can be related to reduce, reuse and recycle.
2. Identify specific actions they can take to implement the Three Rs.
3. Appreciate ... that successfully reducing solid waste depends on individual responsibility and choices.

Background Information (text abridged):

In order to make personal decisions that result in taking some kind of action or in some change in behavior, one must have the knowledge and skills for understanding the complexity of an issue and to investigate the solutions. Decisions are based on one's beliefs and values. Being able to understand the value systems or positions of others regarding a particular issue or subject can help clarify one's own values.

In this lesson, students select and use action verbs to further clarify and expand their understanding of reduce, reuse and recycle. Other "re-" action verbs are interpreted in ways that make the Three Rs more meaningful or operational to students.

Activities (text abridged):

1. Begin by discussing the role of individuals in reducing waste – each is part of the problem and also part of the solution. Have students suggest other words that begin with "re" and explain how they might be interpreted in the context of waste reduction. Have students select or assign them to one of the words listed below (or others):

2. In small groups, have students look up the definitions and encourage them to think of different ways to use the term that each has selected. Some specific questions might include:

- What is the literal meaning(s) of the selected term?
- How does each term relate to the action of reduce, reuse or recycle?
- Is there a hidden meaning or some other way to relate to the Three Rs?
- How does the term relate to our own personal responsibility?

Repair	React
Rethink	Recover
Regain	Reinforce
Remunerate	Rejuvenate
Reimburse	Repay
Regenerate	Refuse
Reconsider	Reclaim
Recognize	Reciprocate
Respect	Resist
Renew	Resolve
Repeat	Respond
Restore	Refrain
Retrieve	Return
Revise	Request
Replace	Renovate
Remediate	Re_____

3. Have students create a small poster or placard with a caption that connects the action verb with the Three Rs. For example, "Resist the Throw-Away Habit: Reduce, Reuse, and Recycle!" (This activity may be done in groups or individually; see next step.)

4. Have students place at least one poster by each wastebasket in the school – tape it to the wall, end of a desk or the side of a cabinet. Discuss the meaning and the effectiveness of the various captions.



This particular lesson can be used to emphasize Show-Me Standards 2.1, 3.1, 3.7, 4.3, 4.6, CA1, and SC8. Collectively, the lessons are designed and organized to help students gain the knowledge and skills leading to responsible consumer behaviors regarding the use and protection of Missouri's natural resources.

For more information about "Re-Source Your Trash," call the Department of Natural Resources at 1-800-361-4827. Copies will be distributed to each of the public school districts in Missouri this summer.

Jim Lubbers is an environmental education and information specialist with DNR's Environmental Assistance Office, within the Division of Environmental Quality.

Missouri Resources Magazine

Summer 1999

When Less is More

*by Dennis Hansen
photographs by Nick Decker*



Missouri's efforts to reduce the amount of solid waste going into landfills is tied not only to waste reduction, but also to such factors as population growth and changing economic conditions.

Items banned by the law included major appliances, whole tires, waste oil and lead-acid batteries. The new law also banned yard waste from landfills. Missouri newspaper publishers helped close the loop by encouraging the use of recycled-content newsprint in the state's larger newspapers. As a result, 1997 recycled-newsprint use averaged 33 percent.

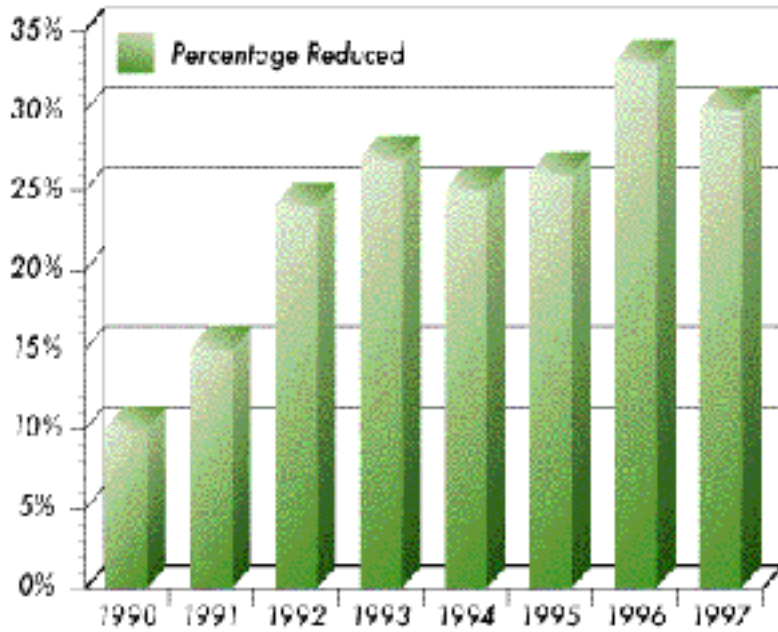
In 1990, then-Gov. John Ashcroft signed Senate Bill 530 into law and changed, perhaps forever, how we as Missourians manage our solid waste. The passage of SB 530 resulted from a concentrated effort by legislators, citizens, environmental groups and others to improve solid waste management in the state.

Among its other provisions, SB 530 established a statewide goal for Missouri citizens to reduce their solid waste disposal in landfills by 40 percent by the end of 1997. Some progress in waste reduction was guaranteed with landfill bans that went into effect early in 1991.

However, the Department of Natural Resources (DNR) believes that timely development and implementation of local solid waste management plans are the best potential tools for achieving waste reduction in Missouri. From the outset, the reduction goal was intended to be a planning tool, serving as a local gauge of successful plan implementation.

Cities, counties and Missouri's 20 solid waste management districts develop local plans. A model

Solid Waste Reduction Percentages by Year



plan was developed by DNR's Solid Waste Management Program (SWMP) to assist these local entities. The law also established the Solid Waste Management Fund, made up of fees collected on each ton of waste disposed of in Missouri landfills or transferred out of state for disposal. A large portion of this fund is used for grant programs for statewide and local waste reduction and recycling. The remainder provides support for the SWMP.

While Missourians reduced waste by 30 percent instead of the targeted 40 percent, the department has a continuing strategy to maximize waste reduction in Missouri.

"The increase in waste reduction over the past seven years means real improvements to the environment. While attaining a goal in a given

time frame is commendable, it is equally important that reduction efforts continue. We are focused on developing long-term solutions for solid waste management that result in sustainable waste reduction," said DNR Director Steve Mahfood.

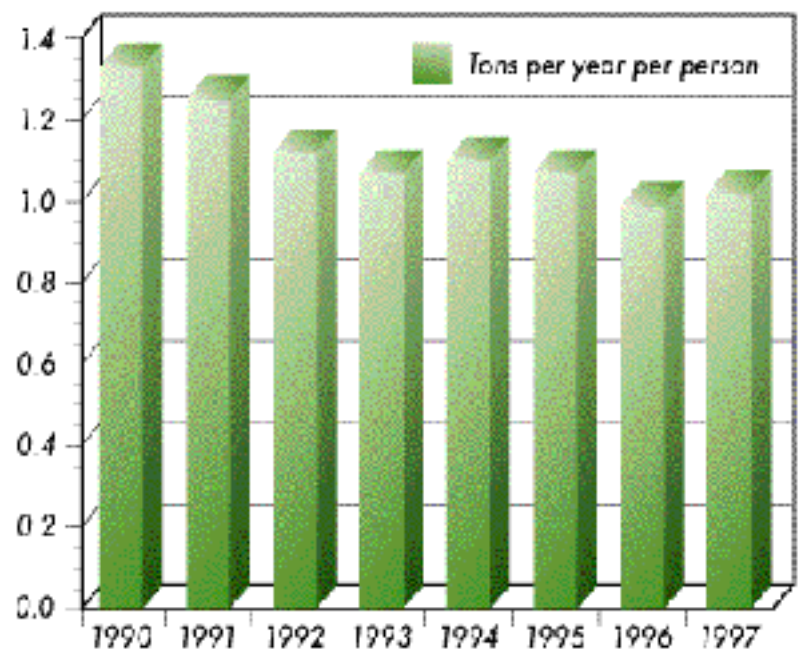
The SWMP, located in DNR's Division of Environmental Quality (DEQ), promotes an integrated approach to solid waste management. This means using a combination of alternatives such as recycling, disposal and waste reduction that best fits local needs. Program staff also provide technical information on short- and long-range planning to solid waste management districts, counties and cities. The SWMP also tracks the progress Missouri is making toward reducing waste. "Protecting the environment requires good planning," said DEQ Director John Young.

"We make decisions based on how to protect our water, air and land from a big-picture perspective. Because of this, we have to be flexible and adapt to shifting resources needs and concerns," Young added.

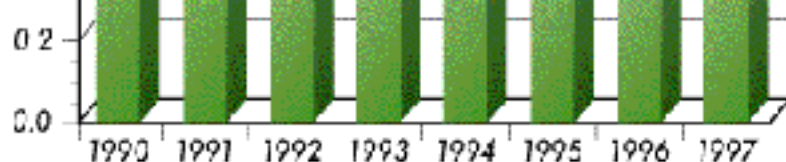
How Do We Measure Waste Reduction Data?

In order to determine Missouri's waste reduction progress, it is necessary to obtain the most accurate data possible. The method the department uses for tracking waste reduction uses 1990 as the base year for measurement. In 1990, an estimate was made of Missouri's solid waste disposal. The base year estimate determined that 6.8 million tons of solid waste were sent to landfills for disposal in 1990.

Missouri Solid Waste Generation vs. Disposal



Seven years later, Missouri sent 5.5 million tons of solid waste to landfills.



One provision of the 1990 law that assisted the data collection process was the requirement that Missouri waste management facilities provide a quarterly tonnage report. These reports include in-state waste disposal and waste exported through transfer stations. Other exported solid waste is estimated by survey of bordering state landfills. This calculation yields a yearly per-capita solid waste disposal rate.

In addition, a constant generation rate is assumed in order to simplify the task of determining annual waste generation. While this has been useful for purposes of calculating reduction rates, it can be assumed that the generation rate fluctuates with prevailing economic conditions. It also should be noted that these numbers include industrial and commercial waste disposal along with municipal solid waste.



A forklift at New World Recycling in Jefferson City loads a compressed bale of beverage cans to be processed into recycled aluminum. Recycling efforts are essential to landfill waste reduction.

Per-capita solid waste disposal is shown to have decreased significantly. In 1990, per-person-solid-waste disposal was 2,660 pounds per year. At the end of calendar year 1997, per-person solid waste disposal was 2,040 pounds per year – a reduction of 620 pounds per person per year. Missouri figures also show a dramatic increase in retail sales. With increased consumer purchasing, one could expect an increase in waste generation. DNR believes this factor and Missouri's increasing population are the primary contributors to the dip in waste reduction between 1996 and 1997.

An article in *Waste Age's Recycling Times* (July 1, 1998) reports that Minnesota, a state considered to be at the forefront of waste reduction and recycling, has experienced a 23 percent increase in municipal solid waste generation from 1991 through 1996. Using Minnesota's 23 percent increase as an example: If Missouri has had a similar increase, its actual waste reduction rate would be at 43 percent. Modification of the present method for computing Missouri's waste diversion might also be considered. This new methodology must incorporate the cyclic waste generation rate that occurs in years of economic prosperity.

Where Do We Go From Here?

There are several avenues that can be considered to reduce waste. Waste-reduction methods include unit-based pricing and cooperative marketing. Unit-based pricing, also referred to as "pay-as-you-throw" places a cost on waste disposal that assumes higher costs for solid waste disposal than recycling. This system, together with convenient recycling opportunities, has been shown to significantly increase the amount of waste diverted from landfills. Cooperative marketing arrangements between cities,

counties or districts can create stronger, more regional markets for recycled materials.

Given the fact that the population and economic base of Missouri have continued to grow, some inherent solid waste growth is inevitable. To stem this increase in waste generation, aggressive outreach is necessary. Large-scale commercial and industrial waste generators should be the primary focus for future waste-reduction efforts to make significant additional waste reduction. Additionally, the most recent statewide grant cycle also has targeted applications that focus on the recycling of construction and demolition waste, since they comprise as much as 13 percent of the Missouri waste stream. It also is important that the focus of sustainable waste reduction and recycling initiatives shift from the supply side to the demand side. Simply put, this means buying products with recycled content.

Until we close the recycling loop by buying goods made from recovered and recycled materials, further waste reduction rates will be more difficult.

Ultimately, managing solid waste and achieving waste reduction goals depend on changing human behaviors.

The publication, Status of Missouri's Waste Reduction Goal, provides background, details, charts and a summary on this subject. Call DNR's Environmental Assistance Office (EAO) at 1-800-361-4827 to receive a free copy of the report, or log on to </alpd/swmp/wastered.htm> to review it online.

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